ENERGY OPTIONS

OVERVIEW PAPER

INDUSTRIAL SECTOR

Broad Application

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1. INTRODUCTION

High energy costs in industry today are a constant reality. But some innovators in plants across Canada have proven the effectiveness of new technologies and approaches to using energy more effectively. As a result, they're cutting operating costs dramatically.

These new and innovative technologies for reducing energy costs in industry have been successfully proven, by your colleagues, through demonstration projects in the areas of heat recovery, efficient combustion and computerized energy management. Collectively, the projects illustrate a wide variety of opportunities for reducing costs. These approaches offer energy savings between 10% and 40%, with payback periods generally under three years.

This paper provides an overview of a number of proven measures together with documentation of important lessons learned.

Suggestions on appropriate next steps and details on resources available are also outlined.

2. OPTIONS

With support from the Federal/Provincial Conservation and Renewable Energy Demonstration Agreements (CREDA) Program, industry has demonstrated, through actual practical projects and installations, the viability of a range of attractive options. Examples follow:

- **Flue Gas Heat Recovery**

  - Over 90% of the energy available in natural gas can be recovered with a condensing flue gas heat recovery unit on the plant's main boiler.

- A small fire-tube boiler can be used as an economizer/heat recovery unit in winter. In summer, or during the "off" season, this small boiler can efficiently supply the plant's reduced energy requirements.

. **Other Heat Recovery Options**

- Use heat exchangers to recover heat from waste vapour and water streams.

- Heat cooler areas of the plant with air from overheated areas by using air circulation fans. When air quality considerations permit, this "thermal averaging approach" will be much more cost-effective than simply exhausting the warm plant air.

- Consider a water or ground source heat pump to provide heat for facility space heating.

. **Indirect-Fired Heaters**

- Consider using high efficiency indirect heaters as replacements for direct-fired heaters. The natural gas units are over 95% efficient, and the hot air produced is virtually free of nitrogen oxides.

. **Integrated Energy Management**

- Use a computer-based process controller to minimize plant energy costs.

- A low-cost personal computer, linked to an in-plant energy management system, can be used to analyze energy use and to identify additional areas where savings can be achieved.

3. CREDA DEMONSTRATIONS

The CREDA projects noted below provide a sample of the many options for reducing energy consumption and costs in industrial facilities. They not only provide tangible evidence of the significant energy cost savings that can be realized in plants, but, also, provide practical installation and operation information.

The demonstration project Case Studies contained in this ENEROPTIONS package are:

MAN 15 Direct Contact Condensing Heat Recuperator - Winnipeg, Manitoba

A condensing flue gas heat recovery unit installed by Canada Packers paid for itself in reduced operating costs in less than three years. The system recovers waste heat from natural gas fired boiler flue gas and transfers it to the plant's process hot water supply.

ONT 45 Low Temperature Flue Gas Heat Recovery System - Welland, Ontario

John Deere Ltd. installed a Beckett Heat Recovery System which saved the company over $35,000 annually. In the winter, a standard fire-tube boiler is used in an economizer with flue gas being cooled to slightly above the dew point. In summer, or during the "off season", the same unit serves as a compact, economical steam source for the plant's reduced requirements. Similar units are installed in the Welland Hospital and at Carleton University in Ottawa.

NB 36 Integrated Energy Management System - Black's Harbour, New Brunswick

A programmable process controller linked to a remote microcomputer is used to monitor, analyze and control energy use at Connors Bros. Ltd. sardine cannery. Recycling and recovery of heat from plant air and water coupled with electrical demand and power factor control result in annual savings of over $79,000.

SASK 12 High Efficiency Indirect Heaters and Air-to-Air Heat Exchangers - Biggar, Saskatchewan

Prairie Malt Limited replaced direct-fired malt drying kiln heaters with high efficiency, indirect heaters and recovered heat from kiln exhaust using condensing air-to-air heat exchangers. Malt quality is improved and kiln fuel costs are reduced by a significant 38%.

ONT 60 Vertical Loop Ground-Source Heat Pump - Toronto, Ontario

Existing oil-fired boilers in an industrial shop facility were replaced with glycol-to-water heat pumps which extract heat from the ground using a series of vertically-buried loops.

Many other applicable projects have been undertaken. Contact your nearest federal or provincial energy office to learn more about nearby projects or those in applications similar to yours.

4. LESSONS LEARNED

Flue Gas Heat Recovery. A direct contact, condensing flue gas heat recovery unit on a natural gas fired boiler can provide a payback period of under three years. The cost of this condensing type unit is reduced by using direct contact water spray to recover heat from the flue gas and by using plastics where possible rather than costlier corrosion-resistant metals.

In non-condensing units, maximum heat recovery is attained by closely controlling the temperature of the flue gas so that it remains close to, but safely above, the dew point to avoid corrosion.

The approaches presented in the ENEROPTIONS case studies generally require, for the recovered heat, a load that is in excess of normal boiler feed water preheating requirements.

Other Heat Recovery Options. The economics of low-grade heat recovery are site-specific and highly dependent upon available uses for the recovered heat.

Uses for the recovered heat, such as preheating water, should be in close proximity to the heat recovery units to minimize the length of costly interconnecting pipes or ducts.

The load profile for the recovered heat should be fairly close to that of the supply, and the higher the daily capacity factor the better.

When using condensing air-to-air heat exchangers to recover heat from dryers and preheat fresh air, icing can occur during cold weather. This problem can be avoided/eliminated through the correct design of ducting and control equipment (e.g., bypass the heat exchanger when the ambient temperature falls below a certain set point). Even with the reduced effectiveness that may be encountered during very cold weather, condensing air-to-air heat exchangers have been found to be cost-effective in particular applications.

Integrated Energy Management. Savings from the control of electrical demand and power factor can go a long way toward justifying a computer-based energy management system. Once installed, this unit can monitor and control other functions, such as heat recovery.

A personal computer can be used to store and analyze data from an in-plant energy management system if care is taken to ensure that the communication hardware and software linking the two machines are fully compatible.

Computerized energy monitoring and analysis greatly facilitates identification of additional conservation measures.

The availability of hard data on actual savings can make it easier to justify investment decisions to senior management.

To avoid incompatibility problems when acquiring computerized systems, specifications should be prepared on a functional basis rather than citing individual pieces of equipment.

5. NEXT STEPS

The demonstration case studies contained in this ENEROPTIONS package present some of the approaches which are applicable in the industrial sector. It is hoped that they will benefit you by:

- indicating applications that may be relevant to you and your organization,

- presenting an accounting of both actual benefits and actual problem areas that you can expect should you pursue a similar initiative.

To assist you, several "next steps" are suggested below:

- Obtain free copies of final reports on projects that are of interest from addresses indicated at the end of the case studies.

- Contact the appropriate demonstration project manager or equipment supplier listed in the case study to obtain further information.

- Establish administrative responsibility for energy consumption and costs in your plant or firm.

- Undertake an energy audit to identify the appropriate package of measures for your facility.

- If you lack the necessary in-house engineering resources to identify and implement the appropriate package of measures, you should consider retaining the services of a qualified engineering consultant.

6. RESOURCES AVAILABLE

Free technical reports are available for most of the CREDA projects listed above. Addresses of appropriate contacts for follow-up, including equipment suppliers and system designers, are listed at the end of each of the attached ENEROPTIONS Case Studies under the "Further Information" section.

The departments or ministries of energy in each province or territory have information on energy conservation and alternative energy and may also have assistance programs. Check your telephone directory for appropriate contact people.

The Conservation and Renewable Energy Offices (CREOs) of Energy, Mines and Resources Canada in each province and territory have information on federal demonstrations, and other assistance programs. Check the back of the attached file folder for the office in your area.

Information on qualified engineering firms and the "Recommended Procedure for the Selection of an Engineer to Provide Professional Services" can be obtained from:

a) The Association of Consulting Engineers of Canada
(Re: ENEROPTIONS)
Suite 616
130 Albert Street
Ottawa, Ontario
K1P 5G4
(613) 236-0569

b) The consulting engineering organization in each province.

Information on innovative financing arrangements can be obtained through the government departments listed above and/or by contacting:

Martin Adelaar
(Re: ENEROPTIONS)
Energy Management Advisor
Energy Conservation and Oil Substitution Branch
Energy, Mines and Resources Canada
580 Booth Street
Ottawa, Ontario
K1A 0E4
(613) 995-1118